A FORM OF MULTIPLE ROCK DIAGRAMS

FRANK F. GROUT
University of Minnesota

A number of suggestions have been made for rock diagrams, designed to show the variation in several constituents through a series of rocks, and a modification is here offered of a method proposed by Adams.[1] He used the chemical analysis directly. This gave a conspicuous line for silica in nearly every analysis. It occurred to the writer that the relative proportions of constituents could be seen more clearly if the analyses were recalculated to the norms,[2] in which a larger number of constituents are usually present in notable amounts. Since the mode sometimes differs from the norm, this method is of course subject to any criticism of the norm as a method of stating rock composition; but it has some advantage over the simple plotting of chemical constituents. Furthermore, the method applies to the mode almost as well as to the norm. Those who do not like the norm can measure or calculate the mode, but in this case relatively few constituents ordinarily attain prominence. It will be recalled that a single feldspar in the mode may be three in the norm, and that certain ferromagnesian minerals in the mode may be divided in the norm.

As a further modification of Adams' method the writer finds it desirable not to plaster the individual rock diagrams together, but to clamp them into position leaving them free for rearrangement, as they are studied from various points of view. Thus in a gabbro (see "A Type of Igneous Differentiation," p. 627) it was of interest to arrange the rocks in what might be called stratigraphic position to see if the magnetite showed a tendency to concentrate at any special horizon; while in the study of differentiation it was

[1] F. D. Adams, "A Graphical Method of Representing the Chemical Relations of a Petrographic Province," *Jour. Geol.*, XXII, 689.

[2] Whitman Cross, J. P. Iddings, L. V. Pirsson, and H. S. Washington, *Quantitative Classification of Igneous Rocks*. University of Chicago Press, 1903.

of interest to try first an arrangement in the order of increasing albite, and then in the order of increasing anorthite, and so on. The sequence and the exceptional rocks are noted in the process of arrangement even more readily than in the photographs.

Attention may be called to certain significant points shown by the diagrams (Figs. 1, 2, and 3). Norms were selected at random

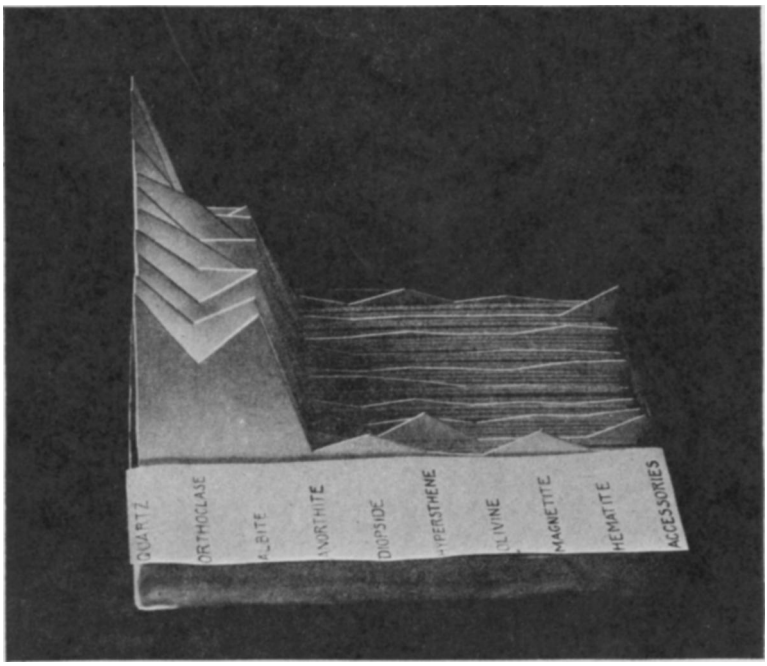

FIG. 1.—A multiple diagram of a series of rocks from the Alaskose subrang in the quantitative classification. The predominance of quartz and alkali feldspars is clear.

in the subrangs in the quantitative system. The contrast in the three pictures is evident; so also is the relative uniformity in the norms of a single picture. A further remark is to be made in this regard, however. The uniformity is clear in the first two but not so clear in the third. This group of rocks is from the class of salfemanes; that is, salic and femic minerals are present in about equal amounts. Salfemanes are grouped according to the relations

of salic minerals, as far as the classification is commonly used. In the subrang Auvergnose the diagram shows that the prominent femic mineral may be either diopside, hypersthene, or olivine. For this reason the diagrams of salfemane subrangs may show a great deal of variation in the femic minerals. However, if the

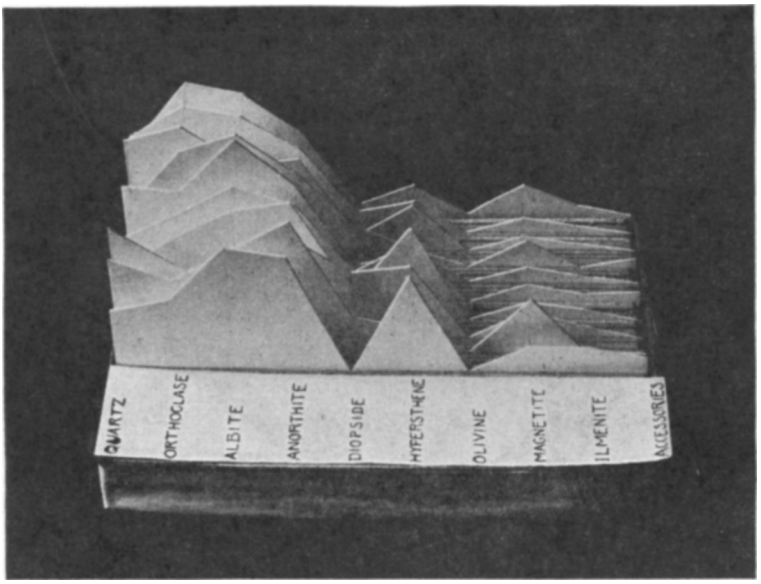

FIG. 2.—A multiple diagram of a series of rocks from the Harzose subrang in the quantitative classification. The quartz and feldspars are predominant here also. but the more siliceous minerals here give way to increased amounts of anorthite.

classification is carried one step farther, to the "grad," these varying rocks would fall in different grads. As a whole it is clear that analyses of a single group in the quantitative classification show their relationship conspicuously in the diagram.

Attention may also be called to the contrasting series shown in the diagrams of "A Type of Igneous Differentiation." The variation in the gabbro series at Duluth shows no tendency to develop a type intermediate between the gabbro and the red rock. The second picture, the red rock, seems to be a strikingly different class of rocks.

In summary the method shows the composition of a series of rocks, with the following advantages. There are no excessive peaks except in case of some rare monomineralic rocks. The diagram can be based on either norm or mode. The cards can be rearranged for the study of each mineral, or the geographic or "stratigraphic" position of the rocks. Certain features of the norm classification are easily visualized by the diagram.

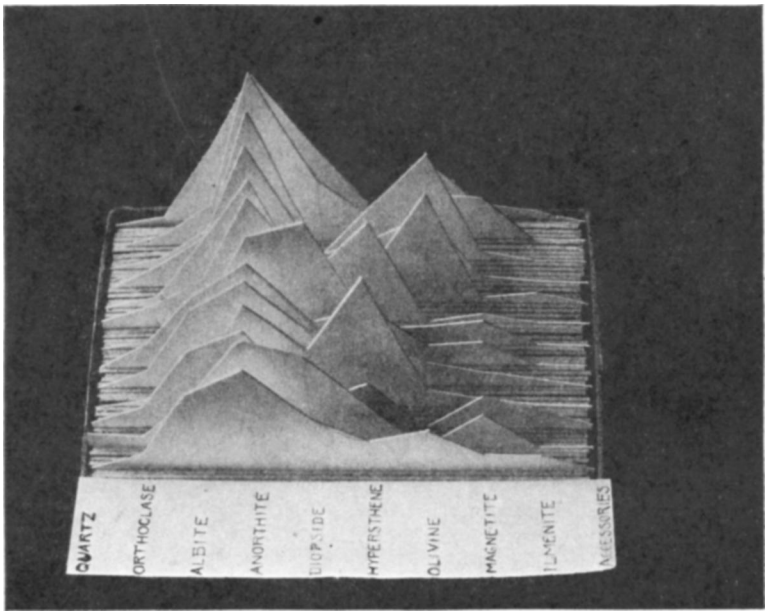

FIG. 3.—A multiple diagram of a series of rocks from the Auvergnose subrang of the quantitative classification. Quartz is negligible and anorthite is prominent. The femic constituents are prominent in this figure but are not uniform. One rock shows abundant diopside, one hypersthene, one olivine.

GEOLOGICAL LABORATORIES
UNIVERSITY OF MINNESOTA
November, 1918